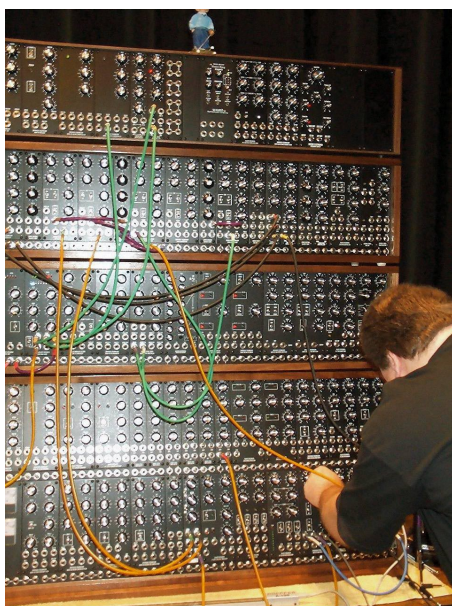
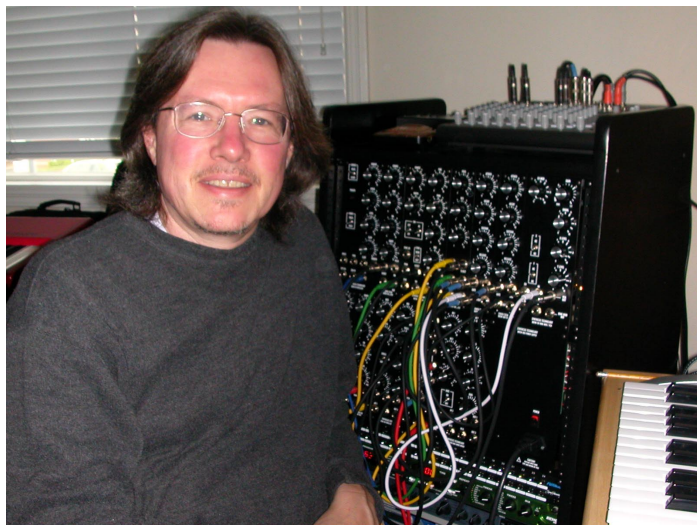
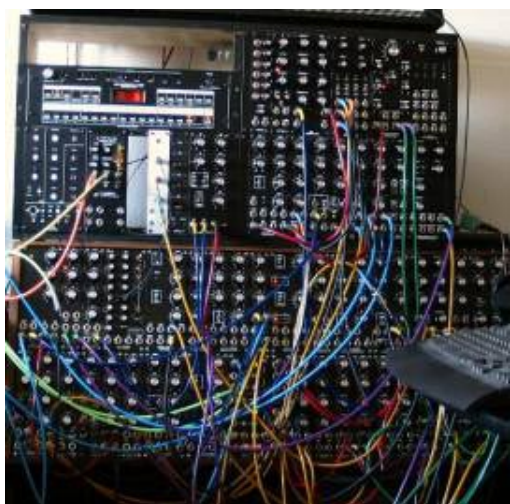


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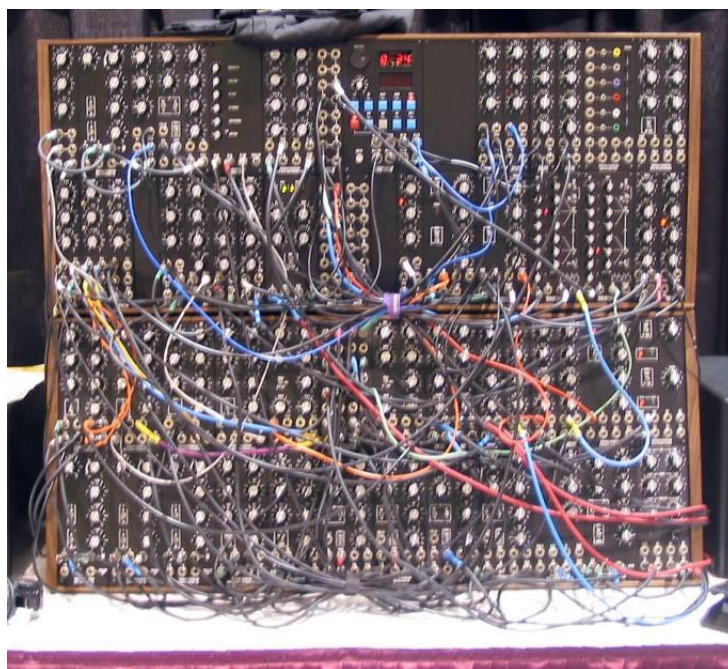
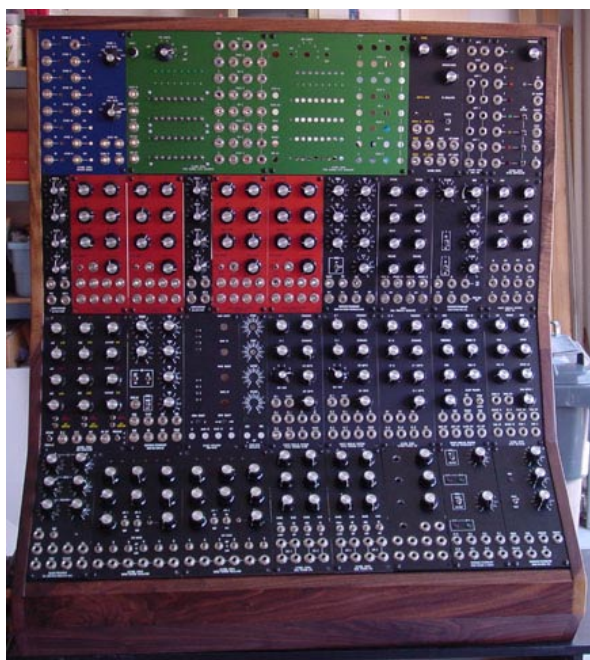
MOTM Analog Modular Synthesizers



July 2004

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Thank you for your interest in the MOTM line of studio-quality modular synthesizer components.

In recent years, the analog modular synthesizer has experienced a rebirth. Although it seems every week there is yet another “softsynth” or plugin announced that claims to have that “vintage analog sound”, we feel that true analog modular sound and the human interaction with the physical panel is the ultimate experience in audio creation.

MOTM modules are designed with only one thing in mind: to be the best analog modular made, past or present. Other modulars are smaller, lighter and cheaper. But none of them approach MOTM’s quality of mechanical construction and sheer audio experience.

The modules are available as kits or fully assembled and tested. Kits are shipped with detailed, step-by-step instructions that even a beginner can follow—we even provide the solder! No arcane or “secret” parts are used—in fact, the manuals provide an in-depth explanation of the included circuit diagrams to help understand exactly how each instrument functions. Module dimensions were designed around the ‘grid’ of a standard 19” equipment rack, which provides for great flexibility in mounting options.

Synthesis Technology stands behind its products. Kits are the best way to save money (your savings will quickly pay for the tools you need to build them, as well as paying for more modules!), and you will enjoy the experience and pride of building your own professional-quality instrument. Our goal is for you to be comfortable owning a MOTM modular, and not spend time worrying over support issues down the road. We offer toll-free tech support, and the MOTM user community is active via Email nearly 24x7—ask a question and usually fellow users will offer help almost immediately. Finally, we offer the following promise: if you build a kit and for **any reason** you think it is not 100% functional, return it to us with \$5 and we will fix it for free, usually within 24 hours. Assembled modules are under a **3 year** return policy.

Synthesis Technology has been shipping MOTM modules since 1998, and has over 5500 modules in studios all across the world: Russia, Greece, Israel, Belgium, Spain, Brazil, UK and Japan to name a few. Chances are, there is already a MOTM user near you! Other manufacturers are adopting the MOTM form-factor for their products, expanding the product line even more. We average 5 new modules every year, and are always asking for input on what to do next.

We are confident that you will be pleased with the MOTM modules’ features, specifications, appearance, longevity, and support.



System Specifications

Physical

MOTM modules have been designed to be easily mounted into standard 19" EIA equipment racks commonly used for holding rack-mount synthesizers, mixers, and effects devices. The useable width of 19" rack is slightly larger than 10 'rack units' (or "U") spaces wide ($1U \cong 1.75"$). There is a 0.015" tolerance 'slop gap', and end plates are available from www.wiseguysynth.com. MOTM modules are in multiples of 1U in width, and 5U in height. Most modules are 2U wide, so 5 of these modules will fit across a rack. We offer the MOTM-19A Mounting Rails for this purpose—they bolt into the 19" rack rails using #10x32 rack bolts, and the modules fasten to these with #8x32 bolts (provided with each module). These rails are stackable vertically, so multiple rows of MOTM modules can fit in the rack.



Reverse side of a MOTM-300 VCO Module

Synthesis Technology does not offer a wood cabinet, but many MOTM users either build their own, or use the walnut cabinets and special flat rails from Larry Hendry at www.wiseguysynth.com. See the detailed photo of typical cabinets on the Accessory page.

MOTM module panels are 0.125" aircraft aluminum coated with a black, durable, baked-on textured finish with white epoxy silk-screening. Circuit boards attach to sturdy steel brackets that fasten to these panels.

Connections between modules are made with robust 1/4" phone plug patchcords (the same as standard unbalanced instrument cables).

Electrical Specifications

The MOTM system was designed to be compatible with existing synthesizer equipment, featuring:

- 1 volt-per-octave response for control of pitch-related parameters (i.e., VCOs and filters)
- Positive-going voltage Gates (+1.5V threshold)
- Positive-going voltage triggers
- Audio levels of 10V peak-to-peak
- VCAs respond to amplitude control voltages from 0 to +5 volts
- Most modules use +/-15VDC (some modules use internal regulators). Some of the 500/600 Series use an additional +5V supply.
- Power supply connector is standard AMP MTA-156 4 position or 6-position for 500/600 Series

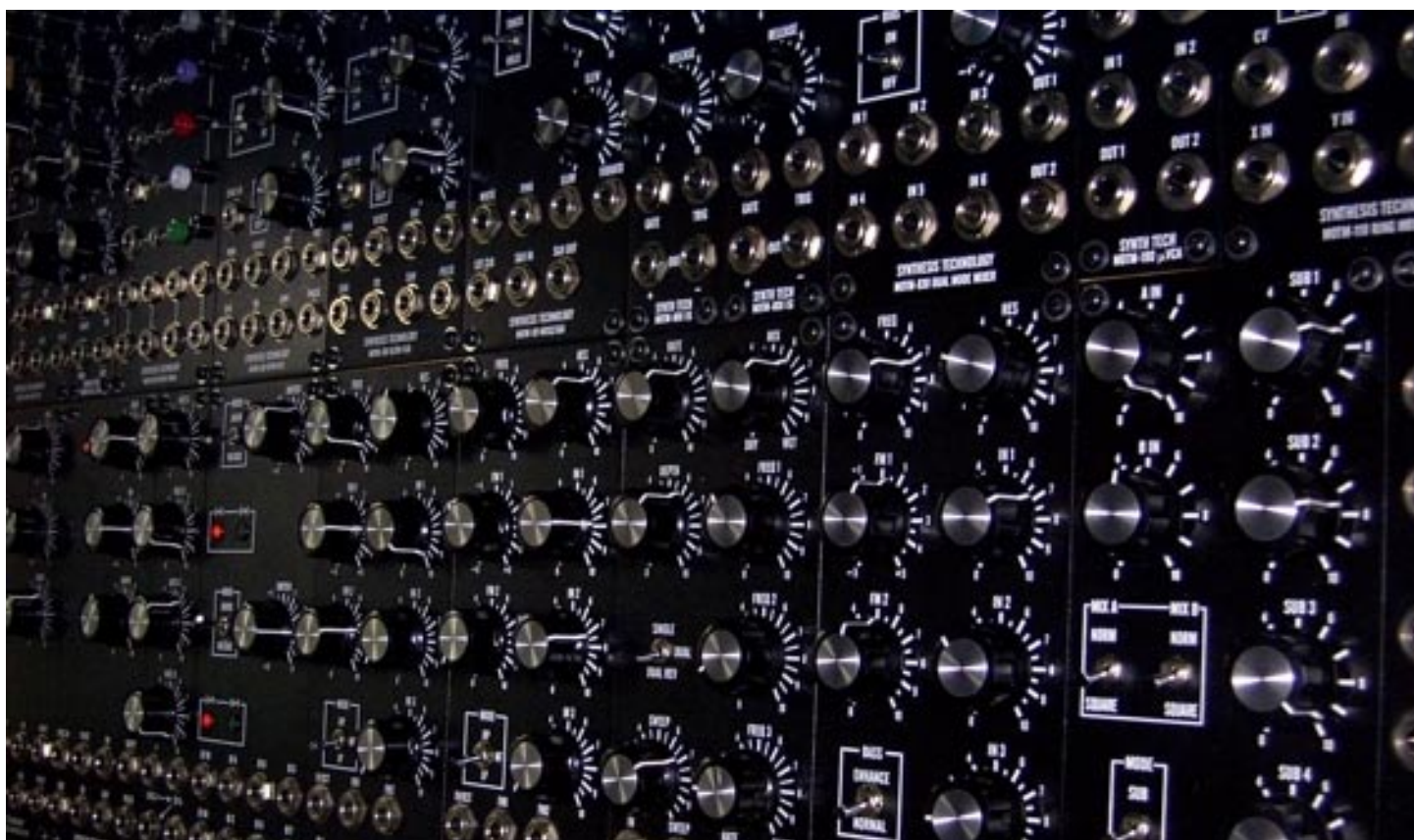
Kits

Every kit is shipped with detailed step-by-step instructions for assembly, as well as calibration and testing procedures, the circuit schematic, and a description of the circuit's theory of operation. In most cases, calibration does not require expensive test equipment.

Kits are supplied with all hardware, including #8x32 bolts for mounting the modules to optional MOTM-19A rack rails, as well as wire and cable, and all solder necessary for assembly.

Components come packed in sorted, labeled re-sealable plastic bags by type ("Resistors," "Capacitors," etc.). These bags are shipped encased in a large 'bubble-wrap' bag.

Each kit has a "difficulty factor" from 1 (easy) to 5 (difficult). The main difference between the kits is in the number of parts, and how close together they are. The MOTM-300 shown here is a 5/5 difficulty.



What modules do I need?

A modular synthesizer by its nature is extremely flexible and extensible. The choice of its components can also be very personal, its module complement selected to fit the needs of its owner. So in a way, this question is kind of like asking, “What color car should I drive?” It’s entirely up to you!

The first, most basic component you need is a good power supply. Without one, nothing else works! It may not be the most ‘fun’ module you will add to your system, but a quality power supply is a critical component that can make or break the noise level specifications and stability of every other module in your system. The MOTM-900 module provides power for twenty or more standard modules and has a connector distribution board to make power hookup simple.

Once you have power, you can start selecting your sound creation, modification, and control modules.

Many MOTM modules can be used as stand-alone modifiers for other instruments, like effects “stomp boxes” or studio post-processing equipment. Look at the line of MOTM filters for this application. Specifically, the MOTM-410 Triple Resonant Filter, which has a self-contained modulation source, can provide stereo spectrum sweeping effects something like a phaser or flanger. Using the (forthcoming) Envelope Follower with one of the lowpass or bandpass filters can produce “auto-wah” effects. The MOTM-120 Sub-Octave Multiplexer can be used to “fatten up” the sounds of monophonic synthesizers, adding incredible low-end. The MOTM-190 Ring Modulator can be used with any 2 audio signals, not just those generated from other MOTM modules, to create enharmonic timbres typically described as ‘metallic’ (it makes for great ‘robot voices,’ too!).

If your plan is to construct a comprehensive modular synthesis system, the choices are wide open, but you can choose your modules in such a way that you can get a small, useable core of modules built up first, and then add functionality as you grow your system. We can offer some advice based on experience.

A ‘standard’ analog synthesizer voice consists of a VCO, VCF, VCA, and EG. For ‘unpitched’ sounds, woodwind ‘chiffs,’ and sound effects, add a Noise Source such as the MOTM-101. This is the basic arrangement you find in classic machines like the Roland SH-101 or Korg MS-10. It is the functional bare minimum to create acoustic instrument simulations or ‘lead synth’ sounds. Synthesis Technology offers several different kinds of module for each of these functions—consult the detailed module descriptions to see what functions are available.

You can build on that framework in many ways. Adding a second oscillator, another filter, and another envelope generator creates an instrument similar to a Korg MS-20. The two VCOs allow you to create rich harmonics, the two filters provide flexible spectrum-shaping possibilities, and the two Envelope Generators allow you to control the VCA and filters independently. For creating vibrato and tremolo, you could use one of the VCOs in a low range to control the other, but you'll probably want to add an LFO for this. The addition of a lag processor will let you control the rate of change of other control sources, so that you can create portamento or 'glide' effects. At this point you have an instrument that can do anything that the venerable Minimoog could do, but with even more features and the added flexibility of a modular synthesizer.

Here are some suggestions for small "starter" systems. Please call or email if you have questions on what modules best suit your musical needs.

System #1: The Absolute Basic Synth

1ea MOTM-900 Power Supply

1ea MOTM-300 VCO

1ea MOTM-420 VCF

1ea MOTM-800 EG

1ea MOTM-190 VCA/RM

1ea MOTM-19A rails

This system fits in 1 row of a 19" rack. It allows the creation of a simple monophonic "voice", although limited by the single envelope generator.

System #2: The Small Modular

1ea MOTM-900 Power Supply

2ea MOTM-300 VCO

1ea MOTM-320 VC LFO

1ea MOTM-440 or MOTM-420 VCF

2ea MOTM-800 EG

1ea MOTM-120 Sub-Octave Mux

1ea MOTM-101 Noise/S&H

1ea MOTM-190 VCA/RM

1ea 1U Blank (reserved for future module!)

2ea MOTM-19a rails

This system is ideal for "replacing" a Minimoog, ARP2600, or other vintage synth. For near the same price, you can get brand-new electronics, free tech support, and a true modular! And, you will find that the MOTM system will generate a much wider tonal palette.

Don't forget that you need a way to *control* your system. The most common way to do this is with a keyboard. Because high quality velocity & pressure-sensitive MIDI keyboards are ubiquitously available at a reasonable cost, and because many synthesists will already own one or more of these, Synthesis Technology does not offer a keyboard controller of its own at this time. Be aware that you will need something to convert the digital MIDI control signal into control voltages that you can use with your modular. A few devices are available for this function, and Synthesis Technology stocks the high quality Kenton line of MIDI-to-CV converters. Contact us or visit our web site for more details and current prices on these units. A good MIDI keyboard and a MIDI-to-CV converter will give your MOTM modular advanced features that vintage modulators never had, such as velocity and aftertouch response, and it will also allow you to use your modular with a PC-based sequencer. With enough modules, you can even create a true analog polyphonic synthesizer!

Other controllers are possible, too, such as '[wood]wind controllers' Theremins, joysticks, and ribbon controllers. The flexibility of your modular may encourage you to experiment with these. The horizons are wide open.

MOTM Modules Product Line



MOTM-101: Noise Generator / Precision Sample & Hold

Kit: \$189 Assembled: \$299 Kit difficulty – 2/5

This is a dual function module, 2U x 5U. The Noise section uses 2 Zener diodes to produce *white* noise, commonly used to create woodwind ‘chiffs,’ percussion, and other unpitched effects. The noise is amplified and filtered to create *pink* noise (a 650Hz low-pass filtered version of white), a slow random voltage (white noise low-pass filtered at 10Hz), and a unique ‘random vibrato.’ This vibrato is a high Q, 7Hz bandpass filter. A front panel control sets the maximum overall amplitude, which randomly varies over time. A switch select the excitation source for the filter. This is a MOTM exclusive function, great for eerily-warbling tones.

The second half of the module is a high accuracy, very low droop rate (on the order of less than 1 semitone per minute) sample and hold. A sample and hold is an analog switch with ‘memory’: the value of the input voltage is ‘saved’ at the output (the ‘hold’ part) each time a ‘sample’ command is received. The S&H circuitry can be switched, using a front panel switch, to either quickly sample the input (using a 1millisecond internal one-shot) or to track the input as long as the input clock voltage is above 1.5 volts. The input is normalised to PINK noise.

The MOTM-101 contains an internal clock generator of 0.2Hz to ~25Hz. This clock is fed to a switched input jack on the front panel. Any zero-crossing signal of at least 3 volts peak-peak amplitude can be used if patched into the External Clock input. The SLEW control adds glide in-between output samples.

The most common use of a S&H is to sample noise, and use the output into a VCO to generate random pitches. The input jack is internally connected to the white noise output, but any signal plugged into the jack switches out the noise source.

SIZE: 3.470 inches x 8.720 inches. Mounting holes are 3.0 inches by 8.250 inches (standard rack spacing). #8-32 hardware. Depth behind panel is 4.5 inches.

PANEL CONTROLS: Vibrato, Internal clock speed, Input signal level, Track/Hold

INDICATORS: LED is lit when the sample clock is active

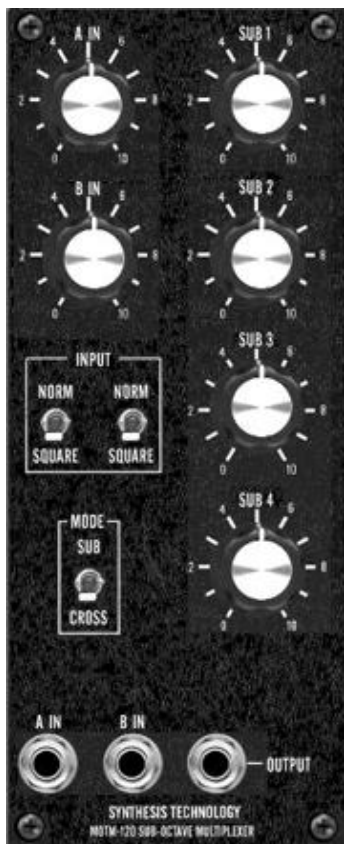
JACKS: Noise section: White, Pink, Random, and Vibrato out

S&H section: External clock in, Signal In, S&H Out

LEVELS: Noise outputs (internal level trim) are nominally set for 10 volts peak-to-peak. The random output may average less.

The External Clock threshold is set for +1.5 volts.

POWER: +-15VDC at 30ma max. Uses AMP MTA-156 4 position connector and cable (supplied)



MOTM-120: Sub-Octave Multiplexer

Kit: \$189 Assembled: \$289 Kit difficulty – 2/5

This unique MOTM module is used to add depth to “thin-sounding” timbres. The MOTM-120 contains two 4-octave sub-dividers. When the input(s) are above 80mv peak-to-peak, the dividers generate 1, 2, 3, & 4 octave-below-input square waves, based on the input signal. Individual level controls allow precise mixing of the input signal (switch selectable between the input and the squared version) and the four sub-octaves.

What sets apart the MOTM-120 from other pulse dividers devices is the *cross mode*. When selected, the two inputs are each sub-divided, and then the 4 suboctaves ring modulated with each other. This produces huge timbre modulations. Even the simplest of sine waves can turn into a complex 16-partial sound.

The MOTM-120 is very easy to use, but can add a new dimension to any mix.

SIZE: 3.470 inches x 8.720 inches. Mounting holes are 3.0 inches by 8.250 inches (standard rack spacing). #8-32 hardware.

Depth behind panel is 4.5 inches.

PANEL CONTROLS: 6 level controls (2 input, 4 suboctaves), input select and mode switches

INDICATORS: none

JACKS: A In, B In, Output

LEVELS: 80mv pk-pk min., 10V pk-pk max.

POWER: +-15VDC at 25ma max. Uses AMP MTA-156 4 position connector and cable (supplied)



MOTM-190: μ VCA (Voltage Controlled Amplifier)/Ring Modulator

Kit: \$199 Assembled: \$299 Kit difficulty – 2/5

The MOTM-190 is a dual VCA and Ring Modulator in a compact 1U size.

The modules contain 2 independent VCAs. VCA#1 can be configured as a VCA or Ring Modulator (RM) by a switch. The top BLEND control acts as either an initial gain setting (VCA mode) or as RM depth (RM mode). In RM mode, the BLEND control mimics the function of the RING lever on a CS-80.

The second VCA can operate in Linear or Exponential response. The two panel controls are for initial gain (from 0 to 1) and for CV attenuation.

Using an all-discrete design with no “special” chips, the MOTM-190 offers low noise, high dynamic range and “CD quality” sound for a low size and price.

SIZE: 1.735 inches x 8.720 inches. Mounting holes are 1.5 inches by 8.250 inches (standard rack spacing). #8-32 mounting bolts included. Depth behind panel is 3.0 inches.

PANEL CONTROLS: VCA#1: BLEND and VCA/RM mode switch. VCA #2: Linear/Exponential mode switch, initial GAIN, CV MODulation.

JACKS: CV IN, audio IN, and audio OUT (both sections).

SIGNAL LEVELS: VCA: CV 0 - 5V, Audio In/Out 10V peak-to-peak (+/-5v)

CONTROL LEVELS: 0 to +5V for unity gain.

IMPEDANCES: 50k minimum input / 1k output typical

POWER: +/-15VDC at 15ma max. Uses AMP MTA-156 4 position connector and cable (supplied)



MOTM-300: Ultra Voltage Controlled Oscillator

Kit: \$329 Assembled: \$429 Kit difficulty – 5/5 (not for beginners)

Note: this kit will require a small amount of heat-sink compound (NOT supplied).

The foundation of any synthesizer lies in its VCOs, and here again is where the MOTM system rises above the old and new modulars. The MOTM-300 Ultra VCO is the most accurate and stable analog VCO ever designed for music synthesizers. Previous VCOs used 1 or 2 simple temperature stabilization loops, or expensive heat-generating “ovens” to keep the pitch from drifting. The MOTM-300 uses five separate temperature compensation loops, which keeps the pitch accuracy within <1Hz over the entire musical scale! The average 24 hour drift is less than 0.4Hz at 8Khz, which is less than 0.005%. No other VCO comes remotely close to this drift stability.

How is this done? Several ways: careful selection of components is a major factor. Attention to design is coupled with absolutely the best parts, such as military-spec summing resistors (0.1% tolerance at 20ppm drift) and state-of-the-art ultra-low drift op amps. The PC board uses controlled impedance, balanced-pair traces and a low capacitance ground plane. These and many other design details make the MOTM-300 the new standard for modular VCOs. The front panel pots are all cermet, sealed construction for reduced temperature drift.

Temperature stability is just one area where the MOTM-300 stands out. Other features include 3 CV inputs (1 fixed at 1V/Octave, the other two can allow up to 1.75 Octaves/Volt scales), Linear FM, PWM, and Hard and Soft Sync. All 4 waveforms are available simultaneously at full 10V peak-to-peak levels.

The MOTM-300 is our most difficult kit to assemble. It is NOT for a beginner. But, like all other kits, we have a 100% satisfaction, 30 day return policy. If you have questions about the skill level required, please call us!

SIZE: 3.470 inches x 8.720 inches. Mounting holes are 3.0 inches by 8.250 inches (standard rack spacing). #8-32 hardware. Depth behind panel is 4.5 inches.

PANEL CONTROLS: Coarse and Fine Initial pitch, FM1 and FM2 attenuators,

Initial Pulse Width, Pulse Width Modulation attenuator

Switches: FM1 Linear/Exponential response, AC/DC coupling, Hard/Soft Sync

JACKS: Sync I/O, 1V/Oct in, FM1 in, FM2 in, Sine, Tri, Saw and Pulse outputs

LEVELS: Audio voltages 10V pk-pk, control voltage -7V to +7V; Sync I/O is a 2uS pulse 0-+5V (active high)

POWER: +/-15VDC at 45ma max. Uses AMP MTA-156 4 position connector and cable (supplied)



MOTM-310 μ VCO

Kit: \$209 Assembled: \$319 Kit difficulty – 3/5

The MOTM-310 is a smaller, less-featured version of the MOTM-300 UltraVCO, but with the same great stability and tracking.

The main use of the MOTM-310 is in conjunction with a MOTM-300. The MOTM-310 is great for driving a SYNC into a MOTM-300, or as the 2nd/3rd VCOs in a ‘voice’. It’s also the perfect sawtooth-driving VCO for a Blacet/Wiard MiniWave.

The SHAPE control is a manual cross-fade between the SAW wave and the PULSE wave. Without a PWM input voltage, the PULSE is a 50% duty-cycle squarewave. The PWM input is a voltage of $-5V$ to $+5V$ (unattenuated) to alter the duty cycle from 0% to 100%. This input can be driven at audio frequencies, unlike other modulators. This will generate wonderful sidebands of harmonic energy, useful for “brash” or “buzzy” timbres. When driven with a $-5V$ to $+5V$ control voltage the range of the VCO is from 0.01Hz to over 25Khz.

The module does not compromise performance *in any way* with the MOTM-300. It will track over 10 octaves within 0.5%, and the long-term temperature drift (after a 15 minute warm-up) is less than 0.5Hz *per day*. Your patches remain session-to-session, and the timbre of the system (VCOs and VCFs) are **repeatable**. This does not mean the MOTM-300/310 sounds “digital” or “cold”, but rather in a studio recording environment, you are not frustrated with drifting pitches and timbres. You can always add randomness to your patches, but you can’t take it out!

SIZE: 1.735 inches x 8.720 inches. Mounting holes are 1.5 inches by 8.250 inches (standard rack spacing). #8-32 hardware. Depth behind panel is 4.5 inches.

PANEL CONTROLS: COARSE and FINE initial frequency, FM attenuator, SHAPE waveform mixing

JACKS: 1V/OCTave, FM, PWM CV and audio OUT

LEVELS: SYNC ($+5V$ positive-going signal), 1V/Oct and FM $-7V$ to $+7V$, SHAPE (0 to $+5V$), waveforms out are $-5V$ to $+5V$.

POWER: $\pm 15VDC$ at 45ma max. Uses AMP MTA-156 4 position connector and cable (supplied)



MOTM-320 Voltage-Controlled LFO

Kit: \$159 Assembled: \$289. Kit difficulty – 3/5

The MOTM-320 is a full-featured Voltage-Controlled Low-Frequency Oscillator (VC LFO). LFOs are typically used to create vibrato effects (patched to the FM input of a VCO), tremolo (patched into the control input of a VCA), or other oscillating sweep effects when used to control filters, phase shifters, etc.

Unlike the crude LFOs found in most synthesizers, the MOTM-320 has 4 individual outputs simultaneously available, plus a master Shape control. This control voltage will shift the shapes of the Pulse, Sine, and Saw outputs in unison. Both 1 volt/octave (temperature compensated!) and variable FM (through a reversing attenuator to go up or down) inputs are available.

Another unique feature is a *Sync* input: a positive voltage will reset all 4 waveforms. You can sync to just about any waveform, from another LFO to Envelope Generators.

The MOTM-320 is not your standard LFO: it has a full-blown VCO core with discrete waveshaping based on the Moog modular and the VCS3! This core has an astounding frequency range of 1 cycle in **30 minutes** to about 2800Hz. A bi-color LED flashes at the LFO rate, and can be set with a jumper to indicate 4 different ways!

Don't sacrifice a VCO as a full-featured LFO: get the MOTM-320 and let the modulations begin!

SIZE: 3.470 inches x 8.720 inches. Mounting holes are 3.0 inches by 8.250 inches (standard rack spacing). #8-32 hardware. Depth behind panel is 4.5 inches.

PANEL CONTROLS: RATE, FM (reversing attenuator) and SHAPE

JACKS: SYNC in, 1V/Oct in, FM in, SHAPE in. SINE, TR, SAW and PULSE waveforms out.

LEVELS: SYNC ($+5V$ positive-going signal), 1V/Oct and FM $-7V$ to $+7V$, SHAPE (0 to $+5V$), waveforms out are $-5V$ to $+5V$.

POWER: $\pm 15VDC$ at 45ma max. Uses AMP MTA-156 4 position connector and cable (supplied)



MOTM-380 Quad LFO (Low-Frequency Oscillator)

Kit: \$129 Assembled: \$199 Kit difficulty – 1/5

You can never have enough LFOs in a modular! Presenting the MOTM-380, with 4 independent LFOs in a 1U wide module. Each LFO is a fixed-frequency (not voltage-controlled) with a range of 0.03Hz to 35Hz.

LFOs 'A' and 'C' output sine waves, while LFOs 'B' and 'D' output triangle waves. The triangles are 'pure', as the LFO oscillator circuitry is based on a reversing integrator scheme (not waveshaped from saw to tri).

Since this is a MOTM module, we had to throw in something unique. See the arrows on the jacks? These indicate that the output 'D' is a passive summation of all the LFOs that are not currently patched. If you insert a patchcord into just the TRI D output jack, you will get the SUM of all 4 LFOS. Inserting a patchcord into the A, B or C outputs disconnects that output from the summed 'D' out.

In this manner, you can decide just how complex the summed output can be: from 1 to 4 LFOs. This allows for some very complex modulation waveforms, without using a single panel control.

SIZE: 1.735 inches x 8.720 inches. Mounting holes are 1.5 inches by 8.250 inches (standard rack spacing). #8-32 hardware. Depth behind panel is 3 inches.

PANEL CONTROLS: RATE (for each LFO)

JACKS: SINE A, TRI B, SINE C, TRI D (the TRI D output is the sum of all unpatched outputs).

LEVELS: -5V to +5V

POWER: +-15VDC at 10ma max. Uses AMP MTA-156 4 position connector and cable (supplied)



MOTM-390 µLFO (Dual)

Kit: \$129 Assembled: \$199. Kit difficulty – 2/5

The MOTM-390 is a dual LFO with one fixed-frequency LFO and one voltage-controlled LFO.

The 'A' LFO features a frequency range of 0.3Hz to 35Hz, and has triangle and square wave outputs.

The 'B' LFO has variable response (0 to 2V/Oct) from 0.01Hz to 200Hz with simultaneous sine, triangle and square outputs.

Two LEDs indicate both LFO rate and LFO waveform amplitude (wired to the triangle waveform for best visual indication).

SIZE: 1.375 inches x 8.720 inches. Mounting holes are 1.5 inches by 8.250 inches (standard rack spacing). #8-32 hardware. Depth behind panel is 3 inches.

PANEL CONTROLS: RATE (LFO 'A'), RATE (LFO 'B') and FM (attenuation for rate CV).

JACKS: TRI and SQUARE (LFO 'A'), FM IN, SINE, TRI and SQUARE (LFO 'B').

LEVELS: outputs are -5V to +5V, FM input range -7V to +7V.

POWER: +-15VDC at 15ma max. Uses AMP MTA-156 4 position connector and cable (supplied)



MOTM-410 Triple Resonant Filter with Dual VCLFO

Kit: \$259; Assembled: \$349. Kit difficulty – 4/5

The MOTM-410 module is based on the PS-3100 Resonator filter structure. It contains three voltage-controlled bandpass filters, and a dual voltage-controlled sinewave LFO. It uses the same "vintage" components as the PS-3100: Vactrol resistive elements for a smoother, 'liquid' phasing sound, and JRC4558 bipolar op amps. However, the control section has been updated to include:

- Voltage-controlled LFO Rate (0.02Hz to 100Hz)
- Voltage-controlled LFO Depth (0-100%)
- Individual filter outputs
- Master SWEEP control voltage

The MOTM-410 can be used as a "fixed" filter bank: just set the DEPTH to zero. Since narrow filters are used, vocal formants can be obtained since each filter has *independent* center frequency controls.

The on-board LFO structure contains 2 "detuned" voltage-controlled LFOs (one LFO is running 20% slower than the other one). The LFOs have true sinewave outputs for best sweeping effects. You can use the panel controls, or plug in up to 3 separate control voltages (SWEEP, RATE and DEPTH)!

Another unique LFO feature is the MODE switch. It controls how the 3 filters are swept as:

- **Single** - All 3 filters are swept together by LFO #1.
- **Dual** - Filter #1 sweeps with LFO #1. Filters #2 & #3 sweeps with LFO #2.
- **Dual Reverse** - Filter #1 sweeps UP with LFO #1, Filter #2 sweeps UP with LFO #2 while filter #3 sweeps DOWN.

The MOTM-410 has 3 separate audio outputs, which can be used to create *frequency-dependent stereo panning*. Using 3 inputs on your mixer, you manually pan Filter #1 LEFT, #2 to CENTER, and #3 to RIGHT. The LFOs then sweep the stereo field, based on the frequency content of what you are playing.

The MOTM-410 can be used with any line-level audio source (synth outputs, mixer effect sends, etc) or integrated in a modular system.



MOTM-420: Voltage Controlled Filter (LP/HP/Notch)

Kit: \$219 Assembled: \$299 Kit difficulty – 3/5

Note: this kit will require a small amount of heat-sink compound (NOT supplied).

A VCF dynamically changes the harmonic content of an input signal, and is often used to filter VCO waveforms. The MOTM-420 is based on the filter from the MS-20, which has a widely recognized "glassy" or "squeaky" tone found on techno, house, acid, and other electro music songs. Unlike the 'Moog filter,' with its 24dB/oct slope and bass punch, the MS-20 used 12dB/oct filters with very high resonance. This resonance was inadvertently input-amplitude dependent, which was a large contributor to its unique sound.

The MOTM-420 uses the same "badness" in the design and the same older bipolar op amps to duplicate the MS-20 sound. The MS-20 used 2 filters in series: a HP (high-pass) followed by a LP (low-pass). The MOTM-420 has switch-selectable HP or LP and adds a Notch function! To exactly duplicate an MS-20 filter section, you will need 2 MOTM-420s. But a single MOTM-420 will still separate your mix from all the other boring LP filters out there! Cutoff Frequency is variable from 1Hz to 28kHz.

Besides being 3 filters in one, the MOTM-420 features a reversing attenuator on one of the CV inputs. This single panel pot allows a CV to be continuously set for negative to positive frequency modulation. This allows an envelope generator to sweep up *or down*. The last great feature: 3 separate audio inputs, each with its own level control. This eliminates the use of a separate input mixer module for most synth patches. The MOTM-420 can be used with most audio sources, such as other synthesizer outputs, drum machines, "direct" boxes, or guitars with active pickups.

SIZE: 3.470 inches x 8.720 inches. Mounting holes are 3.0 inches by 8.250 inches (standard rack spacing). #8-32 hardware included. Depth behind panel is 4.5 inches.

PANEL CONTROLS: Initial Frequency, Resonance, FM1 & FM2 attenuators, and IN1, IN2, and IN3 audio input attenuators.

Switches: filter mode LP/NF/HP

POWER: +15VDC at 18ma max. Uses AMP MTA-156 4

position connector and cable (supplied)

JACKS: Audio: IN 1, IN 2, IN 3, OUT; Control voltage: 1V/Oct (fixed), FM1, FM2

Impedances: Output 1k-ohm nominal, Input 100K nominal

LEVELS: Audio voltages 12V pk-pk max 50mv pk-pk minimum, control voltage -7V to +7V



MOTM-440 Discrete OTA Voltage-Controlled 24dB/Oct Lowpass Filter (featuring VC Resonance)

Kit: \$259; Assembled: \$369. Kit difficulty – 4/5.

Note: this kit will require a small amount of heat-sink compound (NOT supplied).

If you are familiar with music electronics, you have certainly heard of the SSM2040 filter chip, used in the Prophet 5 Rev. 2 synthesizer, the Voyetra 8, and other classic designs. Although the production run of this coveted chip was short-lived, the SSM2040 filter has a unique sound different from a Moog, ARP or other 4-pole lowpass filter. Why? The design used a clever discrete OTA gain cell.

The MOTM-440 offers an updated SSM2040 architecture using matched NPN/PNP pairs and features a switch that adds in a second audio feedback path to boost bass response at higher Q levels. This makes the filter "growl and rumble" even more! In addition, voltage-controlled Q allows for more flexible and unique sweeping effects. Three audio inputs and three CV inputs make the MOTM-440 the killer lowpass in your system. The internal gain structure is such that over-driving the filter is now possible (unlike the Prophet 5) to get even more nasty sounds.

Order an MOTM-440 filter for a fraction of the price of a P5 Rev. 2, but without the worry of obsolete parts!

SIZE: 3.470 inches x 8.720 inches. Mounting holes are 3.0 inches by 8.250 inches (standard rack spacing). #8-32 hardware. Depth behind panel is 4.5 inches.

PANEL CONTROLS: FREQ, RES (Q), IN1, IN2, IN3 input level attenuators, FM1 (reversing attenuator), FM2.

Switches: BASS (Normal or Enhanced)

JACKS: IV/Oct. FM1, FM2 and VC Q inputs, 3 audio inputs (IN1, IN2 and IN3), OUT.

LEVELS: Audio voltages 10V pk-pk, control voltage -7V to +7V;

POWER: +-15VDC at 25ma max. Uses AMP MTA-156 4 position connector and cable (supplied)



MOTM-480 Dual Cascaded State-Variable Filter (CS-80 type)

Kit: \$279; Assembled: \$399. Kit difficulty – 5/5 (not for beginners).

Note: this kit will require a small amount of heat-sink compound (NOT supplied).

The legendary CS-80 sound is based in part on the unique filter arrangement: 2 cascaded OTA-based state-variable filter sections. Each section has a special network to limit the onset of feedback (resonance), which gives the CS-80 "softness". Listen to Eddie Jobson ('U.K.') or Vangelis ('China' and 'Blade Runner') and you can hear this filter in action.

The MOTM-480 duplicates, as close as possible, the filter behavior of the CS-80. Features include:

- Independent cutoff and resonance controls for each section (HP and LP)
- 3 audio inputs with level control
- voltage-controlled resonance
- 1V/Oct response with separate FM input/attenuator
- individual outputs for LP and BP
- internal expansion connector for future output 'taps'

No modular offers as many different filter types as MOTM: get the MOTM-480 to add to your sonic arsenal.

SIZE: 3.470 inches x 8.720 inches. Mounting holes are 3.0 inches by 8.250 inches (standard rack spacing). #8-32 hardware. Depth behind panel is 4.5 inches.

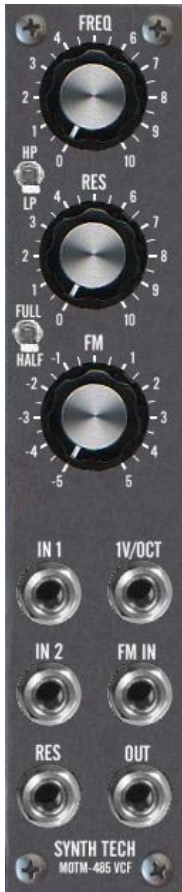
PANEL CONTROLS: FREQ HP, RES HP, FREQ LP, RES LP, IN1, IN2, IN3 and FM attenuation

Switches: none

JACKS: IV/Oct. FM, RES, OUT BP, IN1, IN2, IN3 and OUT LP.

LEVELS: Audio voltages 10V pk-pk, control voltage -7V to +7V;

POWER: +-15VDC at 25ma max. Uses AMP MTA-156 4 position connector and cable (supplied)



MOTM-485 GX-1 VCF (12dB Sallen-Key)

Kit: \$209 Assembled: \$299 Kit difficulty – 3/5

The MOTM-485 is a recreation of the Yamaha GX-1 LP/HP filter. The GX-1 was a massive organ/synth hybrid, costing over \$60,000 in the late '70s. The best example is the ELP song 'Pirates', but was also used by Stevie Wonder and Led Zeppelin.. The actual GX-1 used a pair of these filters to form a bandpass response (the same method used in the MS-20 and the CS-80). There is a HP filter set to "half tracking" followed by a LP at "full" tracking. However, you can still use a single MOTM-485 as yet another distinct tone in your setup.

- Faithfully captures the unique GX-1 timbre
- 2 audio inputs
- voltage-controlled resonance
- switchable HP/LP response
- switchable half/full tracking of the 1V/Oct input
- fully temperature compensated using TEMPCO resistor and matched pairs
- not a 'clean' filter: has higher distortion than other MOTM filters

The MOTM-485 does contain trims that can be adjusted with any DVM.

SIZE: 1.735 inches x 8.735 inches. Mounting holes are 1.250 inches by 8.250 inches (standard rack spacing). #8-32 hardware. Depth behind panel is 4 inches.

PANEL CONTROLS: cutoff FREQ, RES, FM attenuator

JACKS: IN1, IN2, RES, 1V/OCT, FM IN and OUT

SWITCHES: HP/LP and FULL/HALF tracking

LEVELS: -5V to +5V (audio), -7V to +7V (CV)

POWER: +-15VDC at 20ma max. Uses AMP MTA-156 4 position connector and cable (supplied)



MOTM-490: µVCF (24dB Lowpass Ladder type)

Kit: \$169 Assembled: \$249 Kit difficulty – 2/5

The MOTM-490 is a re-creation of the 904A modular lowpass 'ladder' filter. This circuitry is truly discrete: only transistors are used (no op amps) to exactly reproduce all of the characteristic 904A timbres. Great care was taken during the design and testing phases to assure that all of the 904A 'quirks' were in fact duplicated. Among these are:

- resonance only occurs at cutoff frequencies above middle C (about 250Hz)
- the resonance is dependent on audio input levels
- the output level is dependent on resonance
- there is a slight shift in cutoff frequency based on input level
- the exponential converter is not "precision", and hence will drift slightly with temperature
- the filter has a specific THD versus input level curve
- the filter has a specific input overdrive sound

Compact and easy to build, the MOTM-490 can create those distinctive '70s prog rock bass and lead lines.

SIZE: 1.735 inches x 8.735 inches. Mounting holes are 1.250 inches by 8.250 inches (standard rack spacing). #8-32 hardware. Depth behind panel is 4 inches.

PANEL CONTROLS: cutoff FREQ, RES, FM attenuator

JACKS: IN1, IN2, IN3 (audio inputs), 1V/Oct, FM IN and audio OUT

SWITCHES: none

LEVELS: -5V to +5V (audio), -7V to +7V (CV)

POWER: +-15VDC at 15ma max. Uses AMP MTA-156 4 position connector and cable (supplied)



MOTM-510: The WaveWarper

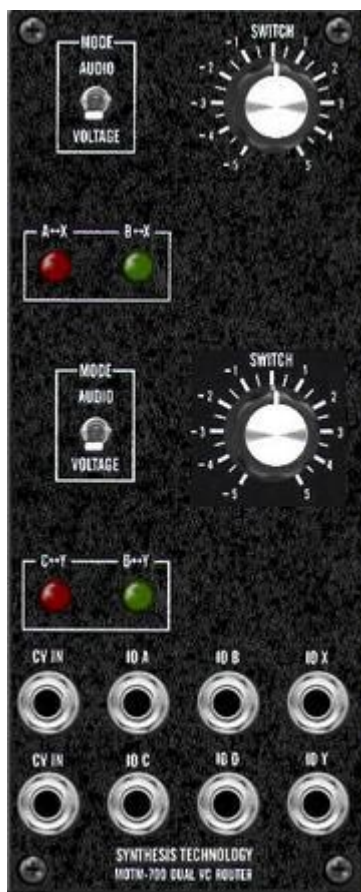
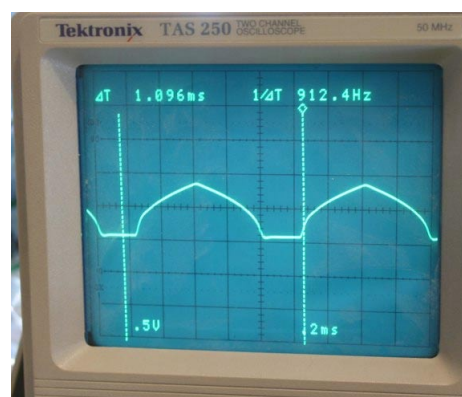
Kit: \$269 Assembled: \$379 Kit difficulty – 3/5

The MOTM-510 is a new kind of analog signal processing module. It's not easy to describe what it does, but I'll try. Let's start with the well-known Ring Modulator (like the MOTM-190). A Ring Modulator (RM) is a multiplier: the output can be written as $Out = X * Y$, where X and Y are the 2 input signals (sometimes referred to as the modulator and the carrier). X and/or Y can be audio or DC signals. The output is simply the voltage X times the voltage Y. This produces the sum of X and Y ($X+Y$) and the difference of X and Y ($X-Y$). The WaveWarper added a 'Warp Factor' exponential term to the equation.

The traditional RM has no 'control voltage' inputs: you just feed 2 signals in, and get 1 signal out. The MOTM-510 takes this concept and generates entire new types of waveforms, such as the warped triangle below:

A 3-position switch sets the overall shape of the warp from convex (ROOT) to RM (UNITY) to concave (POWER). You can add DC offset for non-symmetrical clipping as well. The WaveWarper can warp audio or DC waveforms, creating bizarre LFO shapes.

If you are looking for the ultimate distortion box, than can go from gentle tube-like overdrive to sounding like a jet engine self-destructing with just the twist of a knob, this is your kind of module. Standard 4-pin, $\pm 15VDC$ power used, $\pm 22ma$.



MOTM-700: Dual 2:1 Voltage-Controlled Multiplexer

Kit: \$169 Assembled: \$269 Kit difficulty – 3/5

This module contains 2 identical bi-directional electronic SPDT switches that are controlled by front panel controls and/or input control voltages. If the input voltage is less than the pot setting, then the switch is in the 'A to OUT' position. If the control voltage exceeds the pot setting, then the switch 'flips' to the 'B to OUT' position. Either audio or voltages may be switched, and these can be in any direction.

Special circuitry handles the case of switching audio signals or control (DC) signals. Since switching of audio can easily cause "pops", the MOTM-700 uses a quick 10ms cross-fading VCA circuit to prevent this. For switching DC control signals, a high-speed, very low resistance, very low charge-injection circuit is used. A front panel switch selects the mode. LEDs indicate which signal is being routed.

This module has hundreds of uses in any studio. For example, you can feed 2 drum loops (one in A, one in B) and with a control voltage select which one is heard. The fun is picking the source of the control: it can be a footpedal, an envelope generator, your keyboard CV (instant programmable split point!) or the S&H output of a MOTM-101 (this allows a voltage-controlled probability!) Feeding a LFO triangle as the CV will cause the A and B signals to 'ping-pong', with a duty-cycle easily selected by the SWITCH control. Lastly, if like randomness in your patches, the MOTM-700 is perfect for switching in signals/CVs based on things like the mixed output of a MOTM-380 Quad LFO when all RATE pots are set to minimum.

SIZE: 3.470 inches x 8.735 inches. Mounting holes are 3.0 inches by 8.250 inches (standard rack spacing). #8-32 hardware. Depth behind panel is 4.5 inches.

PANEL CONTROLS: SWITCH (both sections)

JACKS: CV IN, IOA-IOB, IOC-D, IOX-Y

SWITCHES: select AUDIO or VOLTAGE as the mux signals to be selected (each section)

LEVELS: -5V to +5V (audio), -5V to +5V (CV)

POWER: $\pm 15VDC$ at 30ma max. Uses AMP MTA-156 4 position connector and cable (supplied)



MOTM-800: ADSR Envelope Generator

Kit: \$109 Assembled: \$179 Kit difficulty – 1/5

The MOTM-800 is a 1U wide, ADSR envelope generator. Envelope generators create voltage contours when ‘fired’ by a trigger or gate input. These contours are typically applied to the control inputs of VCAs and VCFs to dynamically alter the loudness and harmonic content of a sound over time.

Three different modes of operation are possible:

- both GATE and TRIGGER are used. This will generate a retriggerable full A, D, S, R cycle.
- GATE only. Commonly found in Roland and other keyboards. Will generate a single A, D, S, R cycle.
- TRIGGER only. Commonly found in drum pads. Will generate a AR cycle.

The MOTM-800 features both positive-going and negative going envelopes simultaneously. Since envelope generators are tweaked constantly, the MOTM-800 features long-life Bourns conductive plastic, sealed pots for many years of service. Unlike standard carbon pots on other synths, these pots are not only 100% sealed against dust and moisture, but have silicone lubricant inside the elements for quiet operation for over 500,000 full rotational cycles!

SIZE: 1.735 inches x 8.735 inches. Mounting holes are 1.250 inches by 8.250 inches (standard rack spacing). #8-32 hardware. Depth behind panel is 2.5 inches.

PANEL CONTROLS: ATTACK, DECAY, SUSTAIN, RELEASE

ATTACK, DECAY, RELEASE: <1ms to >10 seconds, typical

SUSTAIN: 0 volts to +5V (OUT +) or -5V (OUT -)

JACKS: GATE in, TRIGGER in, OUT +, OUT - LEVELS:

LEVELS: GATE +1.5V to +13V, TRIG 1ms positive pulse, +3V min. Envelope is 0V to +5V (OUT +) and 0V to -5V (OUT -)

POWER: +-15VDC at 10ma max. Uses AMP MTA-156 4 position connector and cable (supplied)



MOTM-820 Voltage-Controlled Lag Processor

Kit: \$189; Assembled: \$289; Kit difficulty – 2/5

The MOTM-820 is used to add “lag” or “slew” (often called portamento on older analog keyboards) to control voltages. Unlike traditional, simple slew generators of the past, the MOTM-820 offers a quantum leap in terms of features and accuracy.

The MOTM-820 offers *independent control* over rise and fall times. In addition, there is a separate UP/DWN control that adds to both rise/fall, emulating traditional portamento.

But we have gone a step farther: there is a continuously-variable SHAPE control that alters the glide slopes from linear (Minimoog) to log (most other synths) or anything in-between!

The MOTM-820 has a BYPASS function to cut the effect in/out by either the panel switch or remote footswitch (not supplied).

Using precision DC, low drift op amps and 0.1% matched resistors, the MOTM-820 is your ultimate lag processor.

SIZE: 3.470 inches x 8.735 inches. Mounting holes are 3.0 inches by 8.250 inches (standard rack spacing). #8-32 hardware. Depth behind panel is 4.0 inches.

PANEL CONTROLS: UP, DOWN, UP/DOWN and SHAPE

SWITCHES: BYPASS (on/off)

JACKS: BYPASS, UP, DOWN and Up/DWN control voltages, signal IN, and 3 parallel OUTs (OUT1 – OUT3)

LEVELS: BYPASS is a short-to-ground to activate. CV range is -5V to +5V. Input is -7V to +7V.

POWER: +-15VDC at 20ma max. Uses AMP MTA-156 4 position connector and cable (supplied).



MOTM-830: 6:1 or dual 3:1 Audio/CV Mixer

Kit: \$199 Assembled: \$299 Kit difficulty – 3/5

It is very difficult to design a mixer that is *both* DC accurate (low drift and low offset) and “CD quality” (low noise, low THD). You can easily do one, but not both. That is, until the MOTM-830.

Using no caps in the mixer path, the MOTM-830s special, high-dollar op amps try to transparent as much as possible. DC bias can be added if needed.

The module uses a special switching jack on the OUT 2 position. For 6:1 mixing, you use the OUT 1 jack. If a patchcord is inserted into the OUT 2 jack, the internal circuitry “splits” into 2 separate 3:1 mixers. Inputs 1, 2 and 3 are mixed and sent to OUT 1, while inputs 4, 5 and 6 are mixed and sent to OUT 2.

The MOTM-830 is not designed to add gain: it mixes/attenuates only. Note that IN2 and IN3 are controlled by reversing attenuators. This allows signal inversion (audio) and polarity inversion (voltage).

SIZE: 3.470 inches x 8.735 inches. Mounting holes are 3.0 inches by 8.250 inches (standard rack spacing). #8-32 hardware. Depth behind panel is 4.0 inches.

PANEL CONTROLS: IN1 – IN6 level attenuators. DC BIAS.

SWITCHES: BIAS (on/off)

JACKS: IN1 –IN6, OUT1, OUT2 (OUT2 sets 6:1 or dual 3:1 mode)

LEVELS: Inputs are –7V to +7V audio or CV. Output gain set such that with all inputs at +5V and all levels at maximum, the output voltage is +7V.

POWER: +-15VDC at 15ma max. Uses AMP MTA-156 4 position connector and cable (supplied)



MOTM-850 Pedal Interface

Kit: \$129 Assembled: \$199; Kit difficulty – 2/5

The MOTM-850 allows commonly-found 3-wire volume pedals to be used as programmable CV/GATE generators. Such pedals include the Roland EV-5 and Yamaha FC-7, and CV-out pedals such as the Big Briar (pc board jumper selectable). You can also use the MOTM-850 with any low impedance voltage source.

The RANGE and OFFSET controls set the pedal-up to pedal-down voltage output. You can have the output increase or decrease from a set point as the pedal is depressed.

The GATE control sets a threshold to activate the GATE output. The GATE output is at +12V if the CV OUT voltage exceeds the setting of the panel control. This +12V GATE is compatible with all “V Trig” synthesizers and modulars. A LED indicates when the GATE signal is active. You can also, with a pc jumper option, select “S Trig” (inverted GATE) for use with Moog synths.

The MIX IN jack adds whatever voltage is present to the internally generated pedal voltage, and places it on the CV OUT jack. In this manner, you can add in the pedal voltage to say a keyboard CV output. The MIX control attenuates the mixed-in signal.

SIZE: 1.735 inches x 8.735 inches. Mounting holes are 3.0 inches by 8.250 inches (standard rack spacing). #8-32 hardware. Depth behind panel is 3.0 inches.

PANEL CONTROLS: IN 1&2, IN3&4, IN5

POWER: +-15VDC at 10ma

JACKS: PEDAL, MIX IN, GATE and CV OUT.

LEVELS: MIX IN +5V to –5V, GATE out +12V max.



MOTM-890 μMixer

Kit: \$129 Assembled: \$199 Kit difficulty – 1/5

The MOTM-890 is a small “utility” mixer for either audio or control voltage signals. Although not as sophisticated as the MOTM-830 Mixer, the MOTM-890 uses “CD Quality” OP275GP op amps in the signal path for low offset and THD.

In order to conserve space, there are only 3 panel controls for the 5 inputs. Inputs 1&2 are first summed, then the combined level is attenuated (sort of a “post-fader”). Likewise, inputs 3&4 are mixed, then attenuated. Input #5 has it’s own separate level control.

The MOTM-890 is not designed to add gain: it mixes/attenuates only. It is designed to be built in less than 1 hour, and adds a quick and simple 5:1 mixer to your setup.

SIZE: 1.735 inches x 8.735 inches. Mounting holes are 3.0 inches by 8.250 inches (standard rack spacing). #8-32 hardware. Depth behind panel is 3.0 inches.

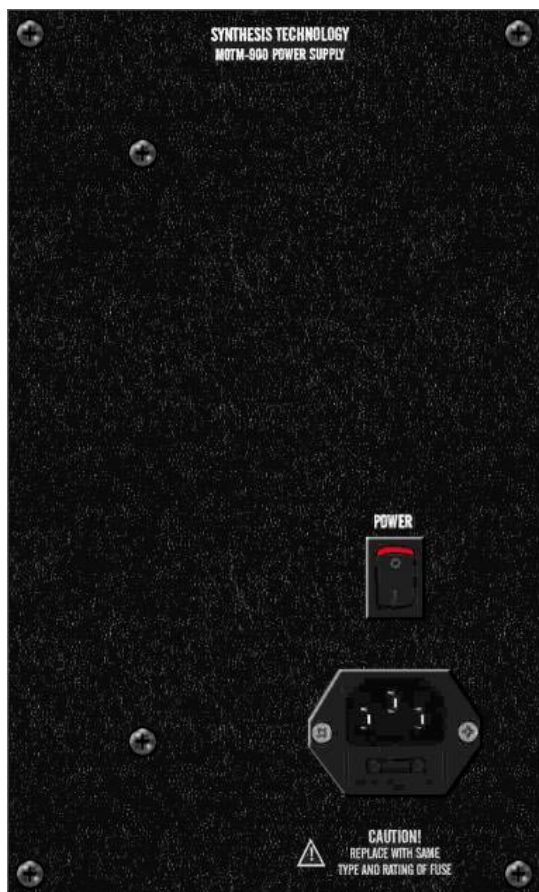
PANEL CONTROLS: IN 1&2, IN3&4, IN5

SWITCHES: none

JACKS: IN1 – IN5, OUT

LEVELS: Inputs are –7V to +7V audio or CV. Output gain set such that with all inputs at +5V and all levels at maximum, the output is +7V.

POWER: +-15VDC at 10ma.



MOTM-900/900ECC Power Supply (dual output)

Kit: \$159; Assembled \$219; Kit difficulty – 1/5

MOTM-950/950ECC Power Supply (triple output)

Kit: \$169; Assembled \$229; Kit difficulty – 1/5

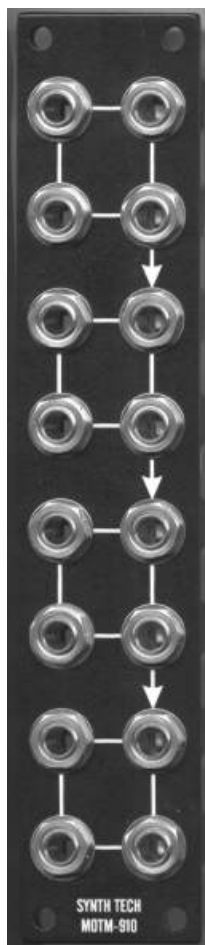
US_CORD: US power cord 3m \$7

The MOTM-900 is a 3U wide, +-15VDC at 800ma power supply sufficient to drive between 20 and 25 MOTM modules. The power supply uses a pre-assembled, pre-tested linear supply with ‘universal’ input voltages. The kit requires very little soldering: most of the connections use pre-assembled ‘FASTON’ wiring that push on the terminals.

The kit contains a small PC board with 12 MTA-156 connectors. The power supply outputs are connected to this board. The other MOTM kits plug into this card using a 20 inch long, 18ga wire harness (supplied with each kit).

The MOTM-950 adds a 3A, +5VDC output. The power connectors are 6-pin MTA-156 type. This supply can power 8-11 “regular” MOTM modules that use the 4-pin connector, and/or up to 6 of the new 500/600 Series modules that require the additional +5VDC.

The ECC models are for non-USA usage.



MOTM-910 Cascaded Multiple Panel

Assembled: \$119

The MOTM-910 contains 4 sets of 4-way multiples. Requiring no power, the '910 is used to "fan out" a signal. For example, if have 5 MOTM-800s and want to send the same GATE signal to each one, how would you do that? The '910 is the answer!

What is unique about the '910 is that special switching jacks are used to 'cascade' the 4 groups from top to bottom on the panel. See the arrows? This indicates the signal path flows from the upper mult group to the ones below it.

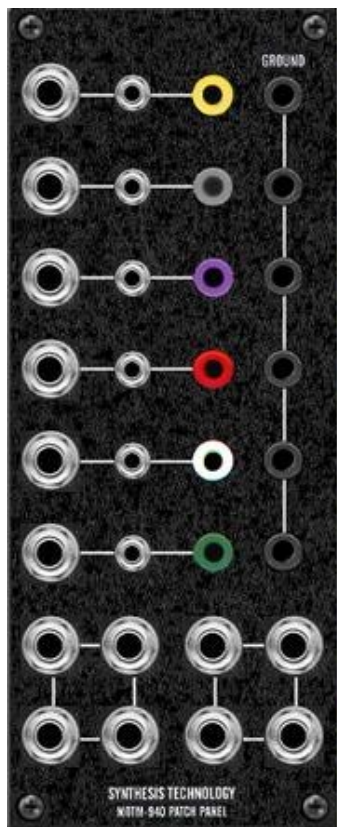
The 3 special switching jacks are located at the 'tail' of the arrow. Plugging a patch cord into these jacks breaks the cascade. So, the groups above the brake are connected, and the groups below are connected.

Lets go through several cases. Let's say you want 2 groups of mults. Inserting a patch cord into the right jack in the second row from the top (the first 'break point') splits the mult as follows:

- a) Group #1 is the first set of 4 jacks
- b) Group #2 is the 3 lower sets of 4 jacks

So, the top group is a "standard" 1-in to 3-out mult, and the bottom is a 1-in to 8-out mult. Remember, you skip over the 2 "break point" jacks in the bottom.

Whew! We hope this explains this clever and useful multiple. Comes assembled only.



MOTM-940: Patch Panel

Assembled only: \$119

The MOTM-940 is a 2U wide module that has:

- a) two 4-way multiples using 1/4" jacks
- b) 6 "adapter" connections using 1/4", 3.5mm, and banana jacks
- c) 6 banana jacks centered 3/4" from the signal jack, tied to ground

This module is entirely passive: no power is required. The main purpose is to allow interfacing with outside equipment that does not use 1/4" cables, without the use of expensive and hard to find adapters. Also, a pair of 4-way multiples using 1/4" jacks is provided to allow multiple feeds of a signal without using "Y" cords.

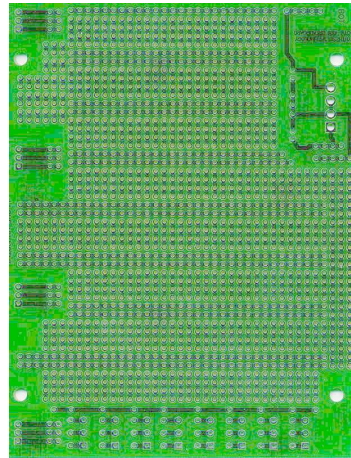
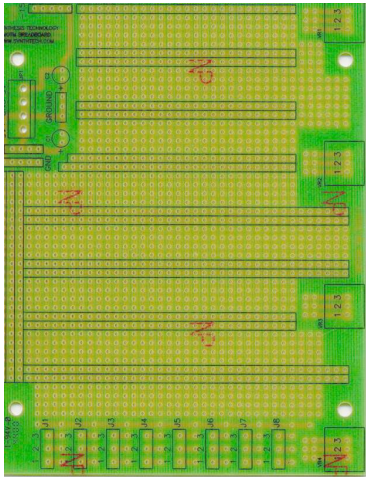
MOTM Accessories

MOTM-000: DIY (Do It Yourself) Breadboard: \$9

MOTM-000-A1: \$15 w/power cable/bracket

The MOTM-000 is a single-sided 'perf' board used for building your own circuits. It uses the same basic form factor as the MOTM PC boards. The MTA-156 power connector is included. There are 4 mounting holes for #6-32 screws that align with the support bracket used in the kits. There are 4 locations for pots, with the 3 signals brought to pads. The 'footprint' is for the Spectrol Model 149 series pots used in the kits, but if you mount the pots to the panel, you can just solder in the holes. There are 18 uncommitted 'power busses' on the board, that are generally connected to ground and +-15V. There are also pads for connecting to front panel jacks.

The PC board is SMOBC (solder mask over bare copper) with an LPI (the best there is) solder mask. A top side silkscreen locates all the busses.



MOTM-19A: Mounting rails for 19 inch racks \$49/pair

The MOTM-19A rail kit contains 2 heavy-duty, 11ga. Steel bars 19 inches long and 0.500 inches wide. They mount vertically across a standard 19 inch equipment rack using #10-32 screws (supplied). You install them 5U (8.250 inches, mounted) apart. Up to 10U width of MOTM modules attach to the rails. Rows of MOTM modules can stack on top of each other using the rails.

The rails are tapped with #8-32 threads, and are painted flat black. The blank panels are black (no silkscreen, mounting holes only) for building your own modules, or filling empty spaces. 0.125 inch thick aluminum. Screws are supplied.

MOTM-1UB: blank 1U wide panel \$11

MOTM-2UB: blank 2U wide panel \$18

PWR-20: Power distribution cable, 20 inches long: \$7

PWR-30: Power distribution cable, 30 inches long: \$9

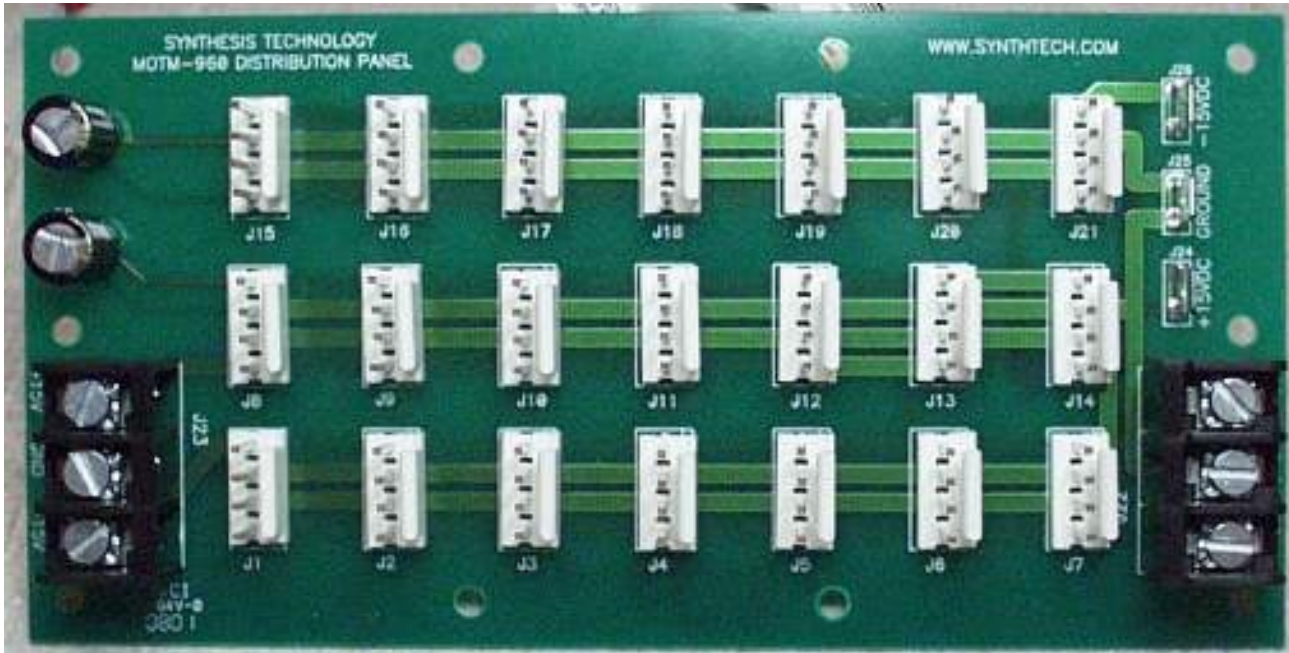
MOTM Hat: black twill with 3-color embroidery logo: \$12

MOTM shirt: black Land's End cotton 'golf' shirt with logo (M, L, XL sizes): \$29



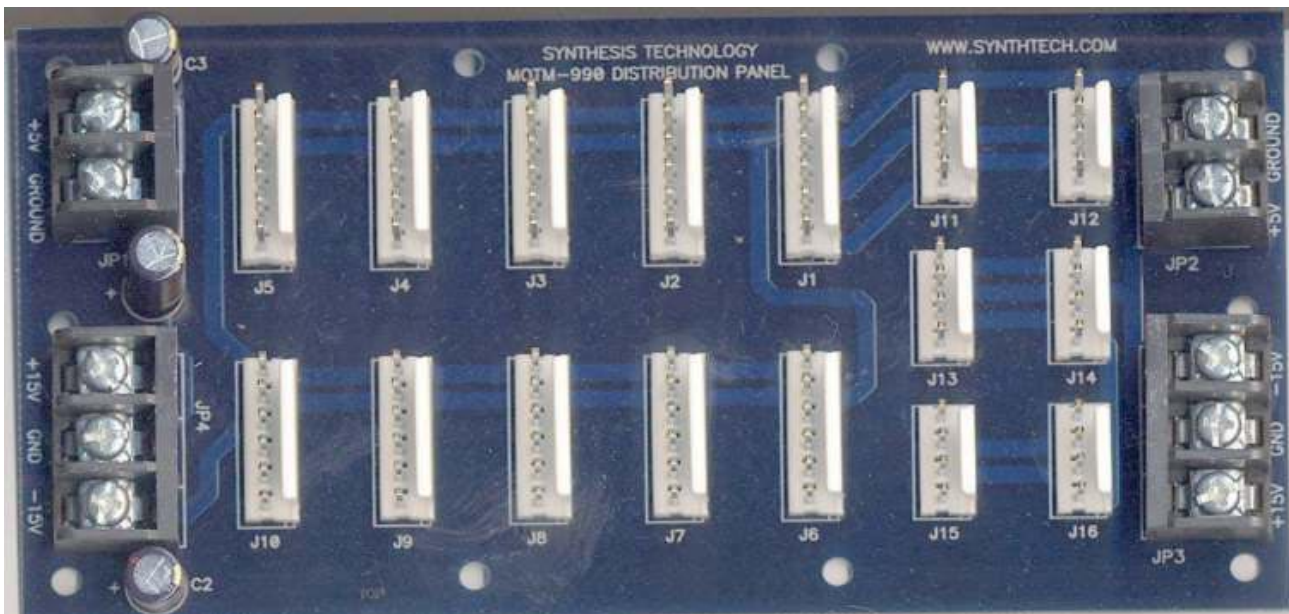
MOTM-960: Power distribution board with 21 connectors: \$39

This is a larger version of the 900-PCB. The size is 3.5" x 7". Contains 21 MTA-156 connectors (3 x 7), 2ea 3-terminal screw terminal blocks for easy wire attachment, 3ea 0.250 FASTON terminals, and ample mounting holes.



MOTM-990: Power distribution board with 16 connectors: \$49

This is a connector board that supports the 500/600 Series 6-pin MTA-156 connector and the standard 4-pin connector. Separate screw terminals are provided for +5VDC and +15VDC. High-quality Panasonic low ESR buld capacitors on each supply rail. Same size and mounting holes as the MOTM-960.

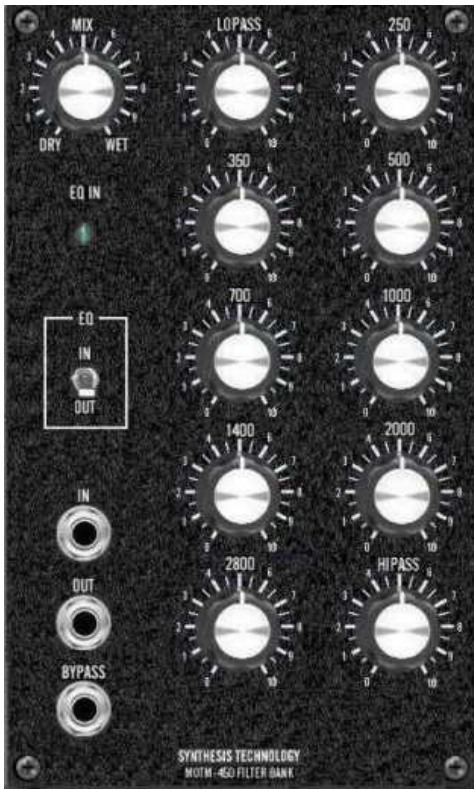


Walnut cabinets from Larry Hendry

MOTM fanatic Larry Hendry of Kokomo, Indiana provides many MOTM accessories via his website: www.wiseguysynth.com . If you lust for the original Moog modular look of fine wood cabinets, Larry has the answer. Available in several sizes, these walnut cabinets are shipped “knocked down” for easy and low cost delivery. Rather than use wood screws to hold the modules in place, Larry sells custom machined ‘flat rails’ that screw into the cabinet, allowing MOTM modules to be easily moved from space-to-space.



MOTM Modules: Upcoming



MOTM-450: Fixed Filter Bank (early 2005)

Kit: \$379 Assembled: \$499 Kit difficulty – 5/5

The MOTM-450 Fixed Filter Bank is an improved version of the classic Moog 907A Filter Bank. The MOTM-450 contains 8 bandpass filters, a lowpass filter and a high-pass filter. Instead of bulky inductors and hand-matched capacitors used in the '907A, the MOTM-450 uses a special class of active filters called a FDNR (pronounced FUD-NER), which stands for Frequency Dependent Negative Reactance. The FDNR simulates the phase response as well as the frequency response of the LRC Moog circuit.

Other fixed filter banks use more 'standard' filter topologies, which do NOT sound the same as the FDNR/Moog 907A circuitry. The disadvantage is that the FDNR requires 3X more parts, which explains the relative higher cost of the MOTM-450 module. However, the sonic quality difference is obvious, as is the 12dB lower noise floor compared to other fixed filter banks (that's 4 **TIMES** lower).

There is an internal expansion connector to allow a companion module, the MOTM-451, to be connected via ribbon cable. This future module brings out the individual outputs of each filter AND envelope followers for each band.

The MOTM-450 uses the standard 4-pin, +-15VDC power connector. The filter can be bypassed with a shorting connection to ground using the BYPASS jack.



MOTM-520 Cloud Generator (mid-2005)

Assembled only: \$429

The MOTM-520 is an entirely *new concept* in VCO design. First, the module is NOT any sort of 'granular synthesis' device. This confusion is due to our use of the term 'Cloud'. But we really couldn't think of a more descriptive term, so this is what we call it.

The MOTM-520 contains 8 independent digital oscillators, each with Sine and Pulse outputs. The Sine outputs are very low distortion, less than 0.1% THD. The Square/Pulse waves can be PWM'd by an external control voltage or even audio. The sum of all 8 oscillators is routed to the SINE OUT and the SQR OUT jacks.

What makes the MOTM-520 generate what we call a 'Cloud' is by spreading apart the frequencies of 7 of the 8 oscillators (1 is the 'reference' pitch). This detuning can be manually adjusted using the SPREAD control, or with an external source (such as a LFO or EG). The WIDE/NARROW switch sets the overall frequency spread (NARROW = 1 semitone, WIDE = 1 octave). The module behaves just like any other 1V/Oct VCO, with standard COARSE, FINE and FM controls and inputs. The difference is that in a 2U space, you have 8 oscillators with no drift or calibration issues. Using SPREAD and SPREAD MODULATION, you can still get huge monophonic leads and interesting wooden percussive sounds. Each oscillator will spread up or down in different sensitivities, and in different directions. All of this creates the most massive bass and lead lines, all in a single VCO module.

But we were not content to stop there. You can ALSO independently modulate the relative *phase* of each oscillator to the reference. And then we went overboard and added one more 'modulation': CHAOS. The MOTM-520 uses the new MOTM-950 Power Supply, which supplies +5VDC as well as +-15VDC (uses a 6-pin MTA-156 connector)



MOTM-600 μ Sequencer (mid-2005)

Assembled only: \$499

The MOTM-600 MicroSequencer (μ Seq) is a 3U wide module that generates 2 control voltages and 2 Gates as a stored sequence in non-volatile FLASH memory. The module contains 9 sequences, each with up to 99 steps. There are 2 4-character, 14-segment 'British Flag' displays, 10 tactile pushbuttons with LEDs, and 2 panel controls. One panel control is an industrial-quality optical encoder. The encoder is used for data entry and menu selections, and also has a 'mouse click' integral pushbutton. A user-assignable VALUE control can modulate parameters in real-time. Up to 3 additional slave MOTM-600s can be connected (via rear MIDI cable) and chained together. Stepping can be internal, external or using MIDI clock. MIDI clock can be divided from 12 to 96 ppq.

What make the MOTM-600 unique is that it can act in three operating modes:

- Stand-alone
- Sync to incoming MIDI Clock
- Driving MIDI Clock out to other devices

As the sequence plays, not only are the CV/Gate outputs active, but so is MIDI OUT. You can have your MOTM system “play along” with external MIDI devices, or force external device to “play along” with the μ Seq!

Even more powerful are the numerous, real-time modulations of the sequencer via CV or MIDI. Change tempo, transpose, skip to another sequence, start, stop, modulate Gate time and change direction are just some of the modulations available. You can download microtuning tables via Sysex and turn quantizing on or off. Requires the MOTM-950 Triple Supply (6-pin MTA connector).



MOTM-650 4-channel MIDI-to-CV Converter (end of 2004)

Assembled only: \$499

The MOTM-650 is a 2U wide, full-featured 4-channel MIDI-CV converter. Up to 4 units can be daisy-chained (via rear connectors) to for a 16-voice system. Features include:

- Voice allocations settable as four 1 voice, two 2 voice, or one 4 voice group - each voice group separately addressable via MIDI
- Voice assignment modes on a per voice configuration: Poly 1, Poly 1 steal, Poly 2, Poly 2 steal, Unison, Solo Unison, Solo, Solo Rotate.
- Dual arpeggiators, each arpeggiator assignable to any active voice group - one arpeggiator per voice group
- Arpeggiator clock sources - MIDI IN Clock, internal clock (60-238BPM weighted), or external. Arp clock(s) can be routed to AUX outs with 1ms/10ms/100ms widths.
- Arpeggiator clock divisors /4, /3, /2, /1.5, 1X, 1.5X, 2X and 4X the clock rate
- Arpeggiator note order as up, down, up/down, and down/up
- Arpeggiator modes are normal, ordered, ping pong, and random
- Portamento - per voice group configurable as constant rate or constant time
- Each voice group is independently configurable
- Firmware updateable via MIDI (Windows and Mac OS 9 update utilities provided)
- All MOTM-650 options settable via MIDI CCs or MIDI System Exclusive commands as well as the front panel user interface
- MOTM-650 Settings and state are remembered across power cycles
- Patch storage for MOTM-650 settings (up to 32) - recallable via MIDI patch change command
- Microtuning per MIDI spec
- Pitch bend adjustable from +/- 0 to 24 to be added to note CV on all voices
- Each of 4 AUX outputs assignable to pitch bend, channel aftertouch, or any MIDI CC.

CC.

The MOTM-650 packs all these features into a 2U wide module, using the latest SMT data converters, low-drift op amps and precision voltage references. Most MIDI-CV converters use 12-bit DACs: the MOTM-650 uses a true 16-bit DAC, and an octal 10-bit DAC for the Velocity/Aux outputs. No other MIDI-CV converter has as many features in a small space. The MOTM-650 requires the MOTM-950 Triple Power Supply (uses 6-pin MTA connectors).





Can I build these kits?

Even if your experience with assembling electronic devices is limited (or non-existent), you *can* successfully build these MOTM kits. What you absolutely need are two things: a bare minimum of tools, and *patience*. Patience is as important as the soldering iron to properly build these kits. As the assembly manuals stress, building these modules is not a *speed* contest, but an *accuracy* contest. The instructions will lead you through the entire assembly, testing, and calibration process, but you must read them carefully and take your time.

The kits may appear overwhelming to some at first, just because even the simple kits have lots of parts. That's the nature (and fun) of analog electronics: parts, parts, parts! That's why they look so cool inside! The #1 rule to remember is that *you do not have to build the kits in one sitting*. All you have to do is clean the solder residue off (with running warm water in the sink) whenever you want to stop.

You can purchase cheap tools and get the job done. But remember this—the modular synthesizer that you build is an investment, both in money and time. Quality tools will make the job much more enjoyable, and will reduce the possibility of damaging components or scratching the module panels. Since you've decided to invest in a modular synthesizer, we urge you to invest in a set of decent tools as well. An investment of between \$125-\$200 should suffice, depending upon what you may already own.

Other Web Resources

Visit these websites for more MOTM information, modifications, and additional info:

www.wiseguysynth.com

www.hotrodmotm.com

Here's what you'll need; some of these tools are absolutely necessary, and others are best thought of as 'must have or you'll be miserable' items:

Soldering iron—A good, temperature-controlled soldering iron (not necessarily a temperature *variable* one) is a must. A non-variable iron is perfectly good for this type of work; a variable iron over the years will be an asset. We recommend the Weller model #WTCPT. The tips are quickly interchangeable. This unit typically costs about \$100. The variable temperature version is model EC1002, about \$250. (Trust me: if you buy the WTCPT soldering iron, it will give you 20-30 YEARS of service: just buy a couple of new tips (about \$5/ea.) every year or so.) Another solution is a Weller model WP35P, 35W iron (about \$43) and a model PH60 stand (about \$19).

Cutters and pliers—Next to a good soldering iron, you *must* have good diagonal cutters. Each module will require about 150 wire cuts of the leads, so a full synthesizer entails *thousands* of cuts. There are many good ones available, ranging from \$90 (EREM) to \$12. Figure on spending about \$20 on a good pair.

Chain-nosed pliers (I use 4 ½" models) are used to bend the leads, pull parts out, etc. Figure on spending about \$12.

A ‘Solder Sucker’—This is a vacuum de-soldering tool. You’ll be doing an awful lot of soldering, but no matter how careful you may be, eventually you will need to *unsolder* something. There are high-end pedal-controlled electric de-soldering stations available, but all you really need is something like the Soldapullit model AS196, about \$21. You ‘cock’ it, then press a button to release a spring-loaded plunger that sucks molten solder right up. It has Teflon tips; it will last a good 5 years if you clean it. Smaller versions are available, but they just don’t have the vacuum of this big boy.

A lead-bending guide—The best \$3.00 you will ever spend. It looks like a narrow plastic triangle about 6 inches long. That’s because it *is* a plastic triangle, six inches long. There are notches along each edge that are calibrated in 0.1" increments. You lay the component in the center channel, placing the leads in the slots, bend the leads downwards with your fingers, and presto! The component is ready for easy insertion into the PCB. Note that most MOTM axial leaded components are on 0.400" lead spacing, which this has a spot for. We recommend Mouser catalog number 5166-801.

Common tools—A set of hollow shaft nut drivers, a good Phillips #1 & #2 screwdriver, and a set of hex keys. There are lots of nuts and screws on an MOTM system, so having these nut drivers is a must. You can buy them individually, but it’s much easier to get these in a set, such as those sold by Xcelite or Craftsman. Just be sure the shafts are hollow, so the nuts on pot and switches can be driven. Using a pair of pliers to tighten the hardware is a bad idea. First, you risk needlessly scratching up the paint. Second, you will never get the nuts tight as with using nut drivers. You will need 2 basic sizes for the nuts: ½ and 5/16ths; plan on paying between \$35 and \$55 for a full set. Again, a good set of these will last you many, many years.

Hex keys are needed for the setscrews on the knobs. You will need a 1/16"; even Radio Shack sells them.

A Digital VoltMeter (“DVM”)—Radio Shack has a wide selection. Check eBay for used Fluke 70 Series meters. Spend about \$50-60 on a model and that will be adequate. It’s awful tough to de-bug a non-working module without one.

A scrub brush—For cleaning the solder flux residue off of the circuit boards. Even a small nail brush is fine.

A magnifying glass—Not necessary, but this is handy for inspecting your solder joints before moving on to the next step, and it can also be useful for reading the tiny markings on some components. Even a small plastic magnifier is helpful; extendable workstation lamps with a fluorescent tube surrounding a large magnifier can be a real help to the serious hobbyist.

Lastly: there is quite a bit of heat-shrink tubing in the kits. Use of this tubing is optional (but it is supplied). You can shrink the tubing with the heat from a cigarette lighter, or by holding the soldering iron tip close to the tubing for a few minutes, but a heat gun (about \$45) will come in handy if you plan to build more than 10 modules. Note that this is NOT a hair dryer (it just happens to look like one). Both Ungar and Weller make good heat guns for <\$50.

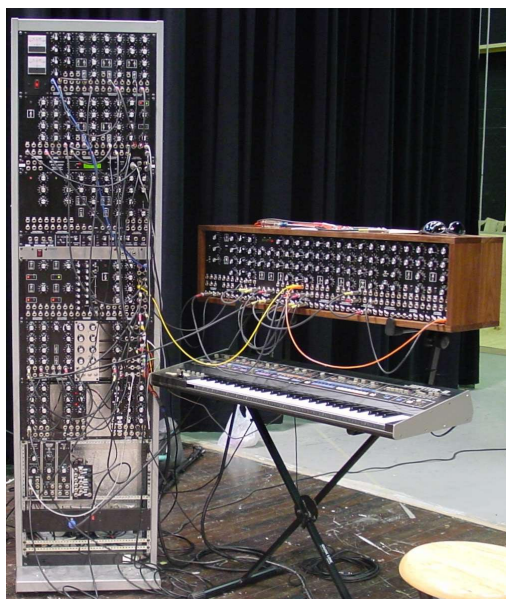
If you have trouble locating any of these electronics tools, try the following sources:

Mouser: 1-800-346-6873; www.mouser.com

Newark: 1-800-4-NEWARK

Techni-Tool: 1-800-832-4866; www.techni-tool.com

Allied: 1-800-433-5700





MOTM Bonus Points

This is the same concept as ‘frequent-flyer miles.’ For every module you buy, you get 1 point. These are lifetime totals--they never expire. They are *not* transferable if you sell your system, however. This program was implemented to reward loyal customers.

Points are redeemed by indicating so on your order. Here is what you can get with accumulated points:

6 points: 20% off any module (up to \$200 in value)

8 points: 33% off any module (up to \$200 in value)

11 points: 50% off any module (up to \$200 in value)

14 points: *free module* up to \$200 in value, includes FREE shipping.

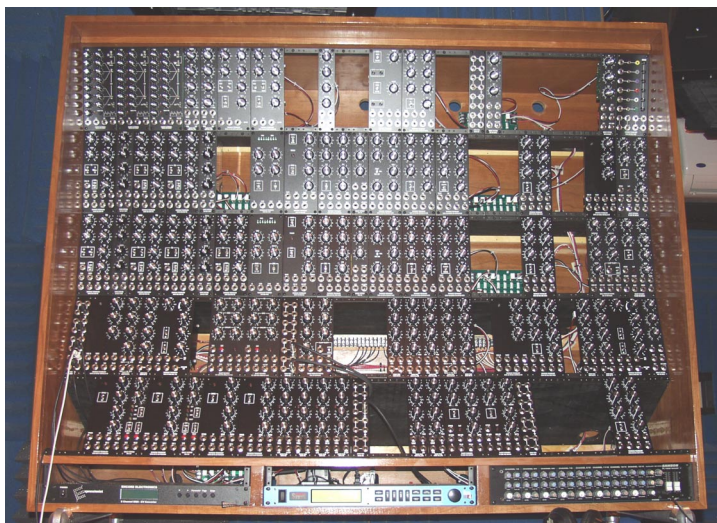
20 points: *2 free modules, free shipping*, up to \$400 total (\$200 per module)

Points are accumulated for *all* orders, for as long as Synthesis Technology is around! There is no expiration date.

For example, if you have 14 points, you can get any kit or assembled module that lists for \$200 or less. You **cannot** get \$200 off of a module that costs over \$200 (sorry!). Modules over \$200 are **exempt** from discounts/freebies using the points system.

Points, once “cashed in”, are lost (like frequent flyer miles). So, if you have 17 points and cash in 14 for the freebie, you have 3.

No, the freebie doesn’t count in the points total for next time.





Payment Methods

We accept PayPal, VISA, MasterCard, and American Express. You can also mail a money order/credit card info for the correct amount. If possible, use the secure order form on www.synthtech.com. However, some 'firewall' programs will not allow the secure form to be sent. You can either:

- PayPal the amount to our account at synth1@airmail.net
- FAX it to 817-605-8401
- Mail the order/credit card info to:

Synthesis Technology/MOTM
6625 Quail Ridge Dr.
Fort Worth, TX 76180 USA

Foreign payment can also be mailed in with a bank draft on a US bank. Money Orders also accepted.

Purchase Orders

Purchase orders (net 30) for orders over \$250 accepted by individual case basis.

Shipping

MOTM kits & Modules

US: \$7 first module/order, \$5 each additional module.

Foreign (2-3 weeks delivery) \$18 first module, \$14ea additional module

EXPRESS service (foreign): 1 week delivery, \$35 first module, \$20ea additional

MOTM-19A Rack Rails

US: \$8/order

Foreign: \$14

Accessories

US: \$4/order

Foreign: \$8/order

Questions?

Please call us with questions from 4PM-11PM weekdays Texas time at either (817) 498-3782 or (817) 281-7776. Our fax number is 817-605-8401. Thanks for your interest in Synthesis Technology and MOTM. There are many exciting modules to follow!